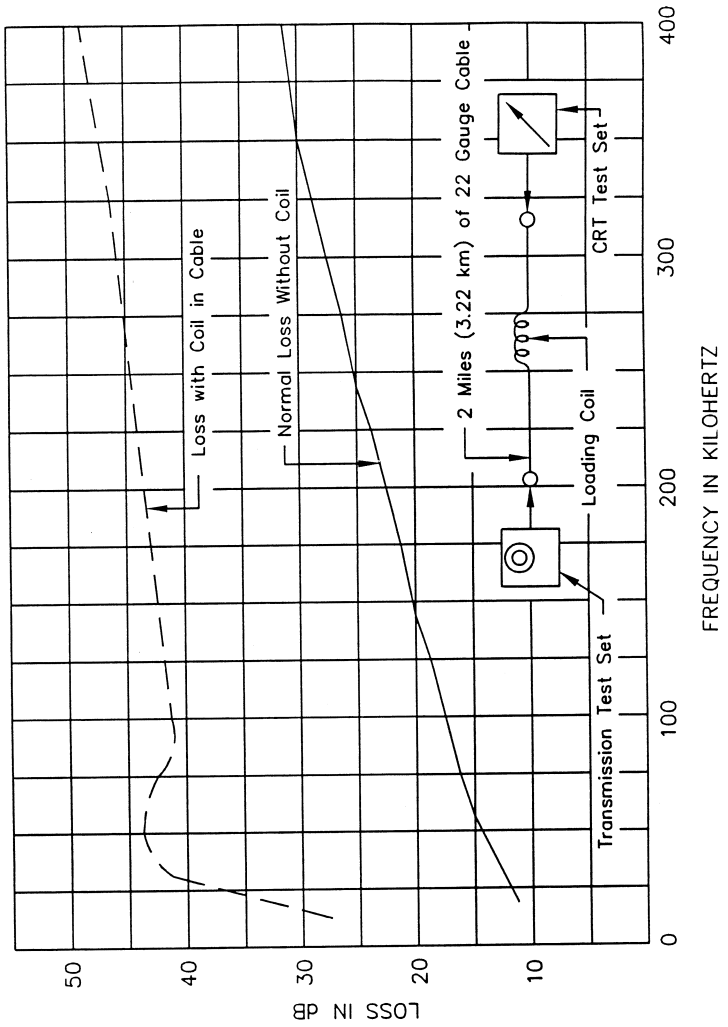
FIGURE 13
EFFECTS OF LOADING COILS ON ATTENUATION



[62 FR 23962, May 2, 1997]

§ 1755.404 Fiber optic cable telecommunications plant measurements.

(a) *Armor continuity.* (1) Tests and measurements shall be made to ensure that the armor of fiber optic cables is continuous. There are two areas of concern. The first is armor bonding within a splice and the second is armor continuity between splices.

(2) Measurement techniques outlined here for verification of armor continuity are applicable to buried fiber optic cable plant. Measurements of armor continuity between splices in aerial, armored, fiber optic cable should be made prior to completion of splicing. Conclusive results cannot be obtained on aerial plant after all bonds have been completed to the supporting strand, multigrounded neutral, etc.

(3) *Method of measurement.* Armor continuity within splices shall be measured with a cable shield splice

continuity test set. The step-by-step measurement procedure outlined in the manufacturer's operating instructions for the specific test equipment being used shall be followed.

(4) *Test equipment.* A cable shield splice continuity tester shall be used to measure armor continuity within splices.

(5) *Applicable results.* When utilizing shield continuity testers to measure armor continuity within splices, refer to the manufacturer's published information covering the specific test equipment to be used and for anticipated results.

(6) *Data record.* Measurement data from armor continuity tests shall be recorded together with anticipated values in an appropriate format to permit comparison. The recorded data shall include specific location, cable size, and cable type, if known, etc.

(7) *Probable causes for nonconformance.* Among probable causes for nonconformance are broken or damaged armors, bad bonding harnesses, poorly connected bonding clamps, loose bonding lugs, etc.

(b) *Fiber optic splice loss measurement.* (1) After placement of all fiber optic cable plant has been completed and spliced together to form a continuous optical link between end termination points, splice loss measurements shall be performed on all field and central office splice points.

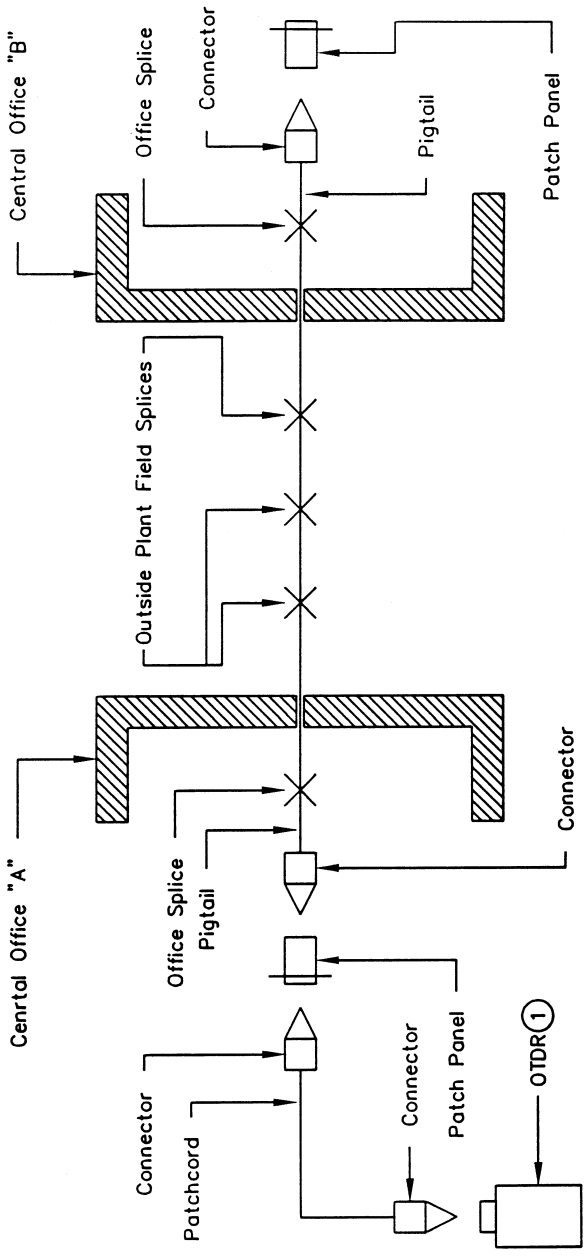
(2) *Method of measurement.* (i) Field splice loss measurements shall be made between the end termination points at 1310 and/or 1550 nanometers for single mode fibers and in accordance with Figure 14. Two splice loss measurements shall be made between the end termination points. The first measurement shall be from termination point A to termination point B. The second measurement shall be from termination point B to termination point A.

(ii) CO splice loss measurements shall be made at 1310 and/or 1550 nanometers for single mode fibers and in accordance with Figure 15. Two splice loss measurements shall be made between the end termination points. The first measurement shall be from termination point A to termination point B. The second measurement shall be from termination point B to termination point A.

(3) *Test equipment.* The test equipment is shown in Figures 14 and 15. The optical time domain reflectometer (OTDR) used for the testing should have dual wave length capability. Figures 14 and 15 are as follows:

FIGURE 14

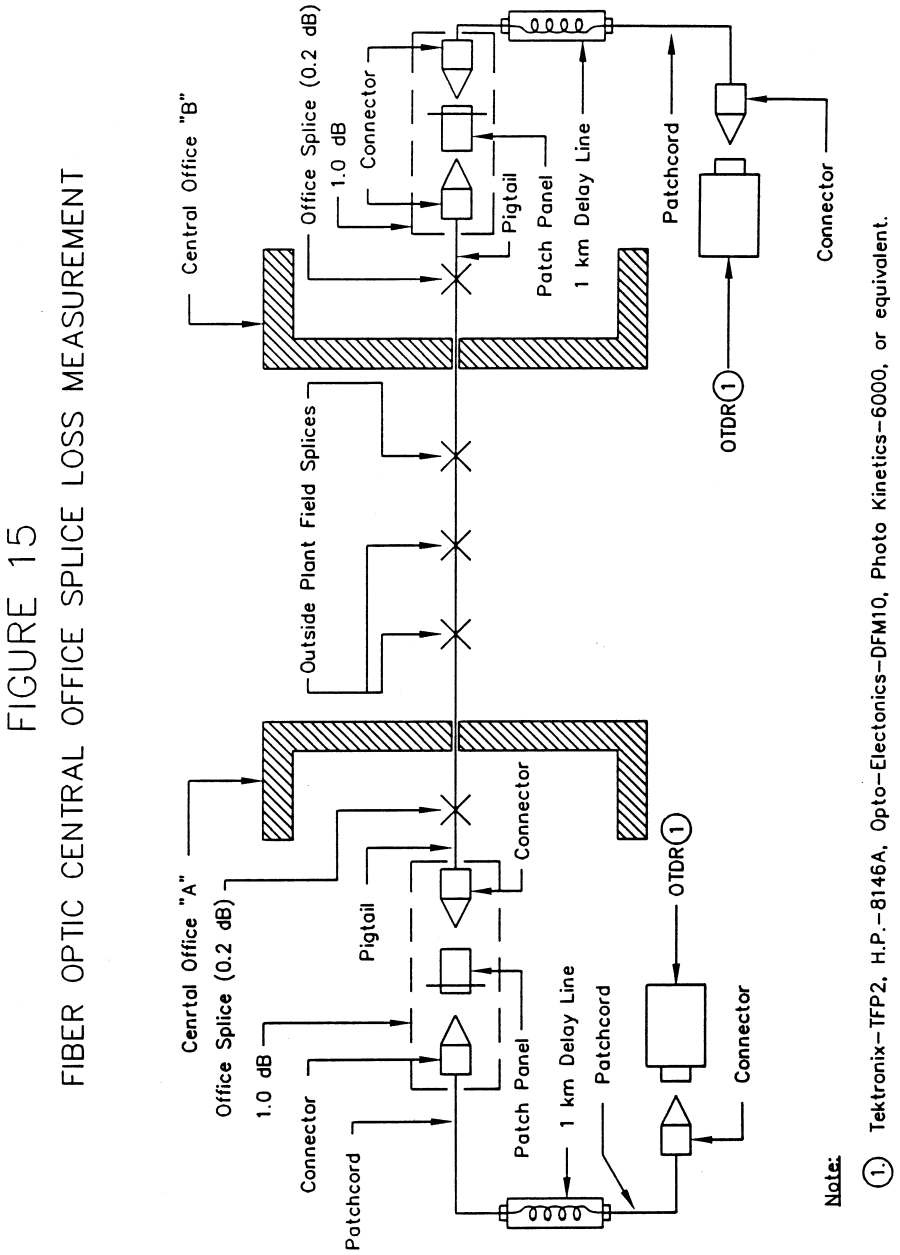
FIBER OPTIC FIELD SPLICE LOSS MEASUREMENT



Note:

(1.) Tektronix–TFP2, H.P.–8146A, Opto–Electronics–DFM10, Photo Kinetics–6000, or equivalent.

FIGURE 15
FIBER OPTIC CENTRAL OFFICE SPLICE LOSS MEASUREMENT



(4) *Applicable results.* (i) The splice loss for each single mode field splice shall be the bi-directional average of the two OTDR readings. To calculate the actual splice loss, substitute the OTDR readings maintaining the sign of the loss (+) or apparent gain (−) into the following equation:

$$\text{Actual Splice Loss (dB)} = \frac{\text{OTDR Reading From A to B} + \text{OTDR Reading From B to A}}{2}$$

(ii) When specified in the applicable construction contract, the splice loss of each field splice at 1310 and/or 1550 nanometers shall not exceed the limit specified in the contract.

(iii) When no limit is specified in the applicable construction contract, the splice loss of each field splice shall not exceed 0.2 dB at 1310 and/or 1550 nanometers.

(iv) The splice loss for each single mode CO splice shall be the bi-directional average of the two OTDR reading. To calculate actual splice loss, substitute the OTDR reading, maintaining the sign of the loss (+) or apparent gain (−), into the equation specified in paragraph (b)(4)(i) of this section.

(v) When specified in the applicable construction contract, the splice loss of each central office splice at 1310 and/or 1550 nanometers shall not exceed the limit specified in the contract.

(vi) When no limit is specified in the applicable construction contract, the splice loss of each central office splice shall not exceed 1.2 dB at 1310 and/or 1550 nanometers.

(5) *Data record.* The measurement data shall be recorded. A suggested format similar to Format V, Outside Plant Acceptance Test—Fiber Optic Telecommunications Plant, in §1755.407 or a format specified in the applicable construction contract may be used.

(6) *Probable causes for nonconformance.* When the results of the splice loss measurements exceed the specified limits the following factors should be checked:

(i) Proper end preparation of the fibers;

(ii) End separation between the fiber ends;

(iii) Lateral misalignment of fiber cores;

(iv) Angular misalignment of fiber cores;

(v) Fresnel reflection;

(vi) Contamination between fiber ends;

(vii) Core deformation; or

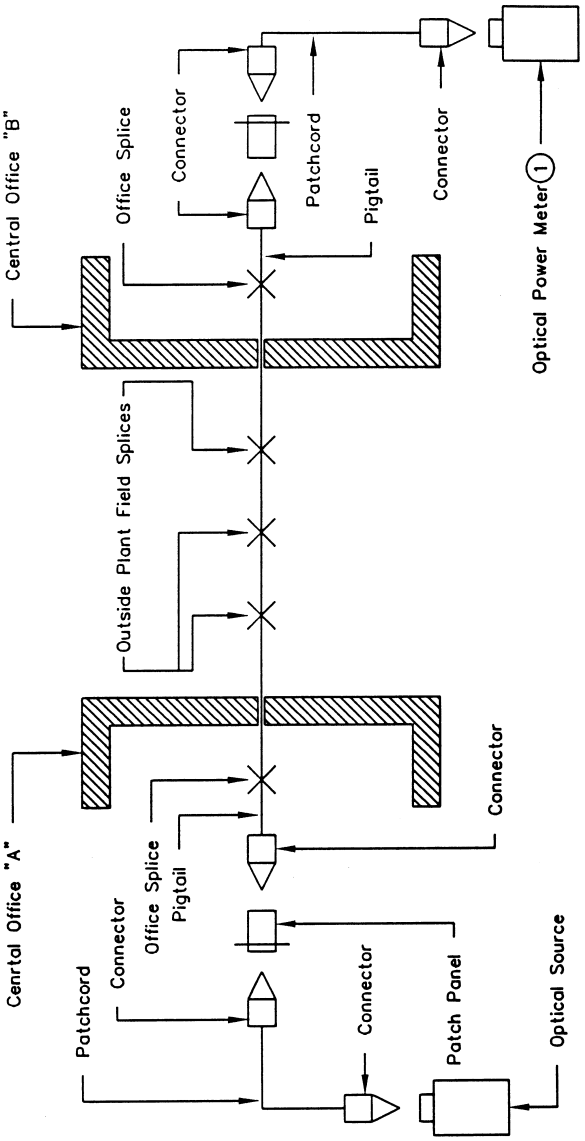
(viii) Mode-field diameter mismatch.

(c) *End-to-end attenuation measurement.* (1) After placement of all fiber optic cable plant has been completed and spliced together to form a continuous optical link between end termination points, end-to-end attenuation measurements shall be performed on each optical fiber within the cable.

(2) *Method of measurement.* For single mode fibers, the end-to-end attenuation measurements of each optical fiber at 1310 and/or 1550 nanometers in each direction between end termination points shall be performed in accordance with Figure 16.

(3) *Test equipment.* The test equipment is shown in Figure 16 as follows:

FIGURE 16
END-TO-END FIBER OPTIC ATTENUATION MEASUREMENT
SHOWING MEASUREMENT IN ONE DIRECTION ONLY (2)



Notes:
(1) H.P.-8153A, Tektronix-OCP5002, Telecommunications Techniques Corp.-131, or equivalent.
(2) Measurement is repeated by reversing location of the optical source and optical power meter in the respective central offices.

(4) *Applicable results.* The end-to-end attenuation of each single mode optical fiber at 1310 and/or 1550 nanometers shall not exceed the limits specified in the applicable construction contract.

(5) *Data record.* The measurement data shall be recorded. A suggested format similar to Format V for fiber optic telecommunications plant in §1755.407 or on a format specified in the applicable construction contract may be used.

(6) *Probable causes for nonconformance.* Failure of each optical fiber to meet the end-to-end attenuation limit could be attributed to the following:

(i) Excessive field or central office splice loss;

(ii) Excessive cable attenuation; or

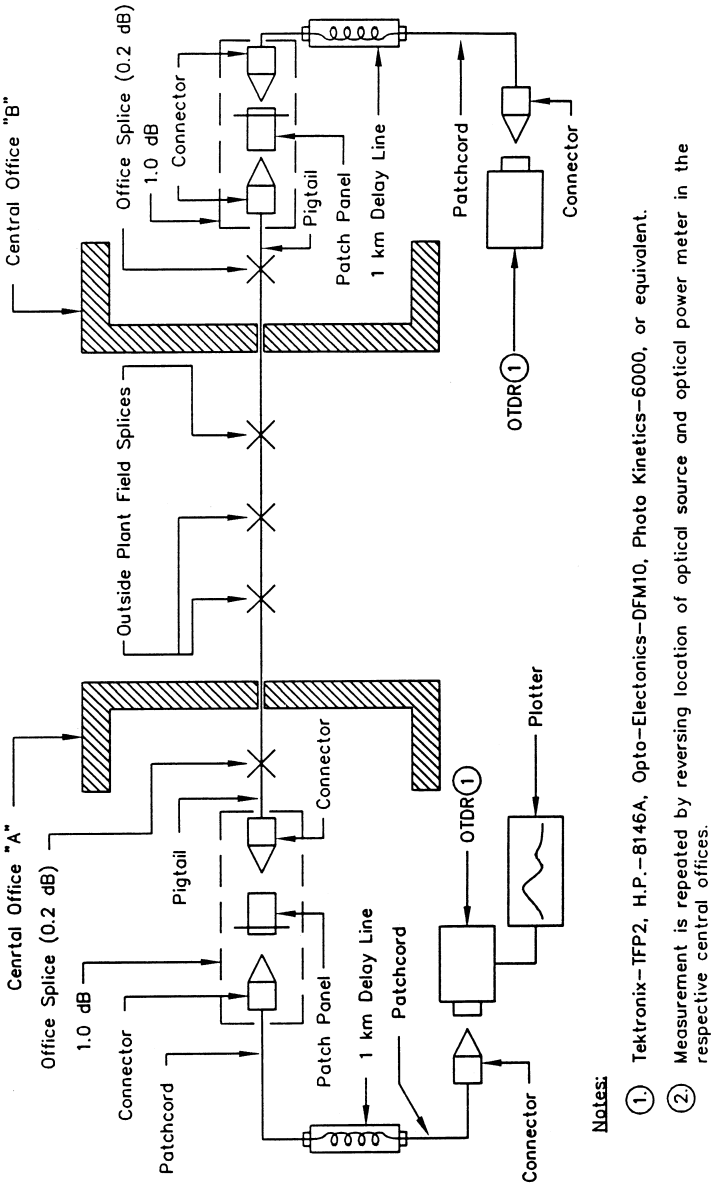
(iii) Damage to the fiber optic cable during installation.

(d) *End-to-end fiber signature measurement.* (1) After placement of all fiber optic cable plant has been completed and spliced together to form a continuous optical link between end termination points, end-to-end fiber signature testing shall be performed on each optical fiber within the cable.

(2) *Method of measurement.* For single mode fibers, the end-to-end fiber signature measurement of each optical fiber in each direction shall be performed between end termination points at 1310 and/or 1550 nanometers in accordance with Figure 17.

(3) *Test equipment.* The test equipment is shown in Figure 17 as follows:

FIGURE 17
END–TO–END FIBER OPTIC SIGNATURE MEASUREMENT
SHOWING MEASUREMENT IN ONE DIRECTION ONLY ②



(4) *Applicable results.* The appearance of each optical fiber between end termination points.

(5) *Data record.* Plot the trace of each optical fiber and retain as a permanent record for future comparison if needed.

(6) *Probable causes for nonconformance.* None.

[62 FR 23989, May 2, 1997; 62 FR 25017, May 7, 1997]